NBSG72AMNEVB

NBSG72A Evaluation Board User's Manual

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EVAL BOARD USER'S MANUAL

Description

This document describes the NBSG72A evaluation board and the appropriate lab test setups. It should be used in conjunction with the device data sheet, which includes specifications and a full description of device operation.

This board is used to evaluate the NBSG72A GigaComm fully differential 2×2 crosspoint switch with Output Level Select (OLS) capabilities. The OLS input of the NBSG72A is used to program the peak-to-peak output amplitude between 0 and 800 mV in five discrete steps.

The board is implemented in two layers and provides a high bandwidth 50 Ω controlled impedance environment for higher performance. The first layer or primary trace layer is 5 mils thick Rogers RO6002 material, which is engineered to have equal electrical length on all signal traces from the NBSG72A device to the sense output. The second layer is 32 mils thick copper ground plane.

For standard lab setup and test, a split (dual) power supply is required enabling the 50 Ω impedance from the scope to be used as termination of the ECL signals, where V_{TT} is the system ground (V_{CC} = 2.0 V, V_{TT} = V_{CC} − 2.0 V and V_{EE} is −0.5 V or −1.3 V, see Setup 1).

What measurements can you expect to make?

The following measurements can be performed in the single-ended (Note 1) or differential mode of operation:

- Frequency Performance
- Output Amplitude (V_{OH} /V_{OL})
- Output Rise and Fall Time
- Output Skew
- Eye Pattern Generation
- Jitter
- V_{IHCMR} (Input High Common Mode Range)

1. Single-ended measurements can only be made at V_{CC} – V_{EE} = 3.3 V using this board set-up.

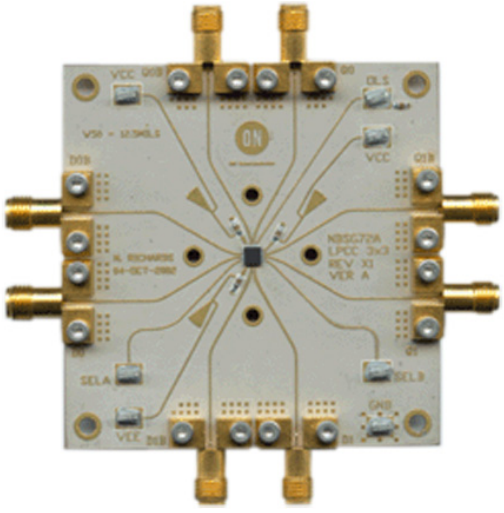

Figure 1. NBSG72A Evaluation Board

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SETUP FOR TIME DOMAIN MEASUREMENTS

Table 1. BASIC EQUIPMENT NEEDED

Description	Example Equipment (Note 2)	Qty.
Power Supply with 2 Outputs	HP6624A	1
Oscilloscope	TDS8000 with 80E01 Sampling Head (Note 3)	1
Differential Signal Generator	HP 8133A, Advantest D3186	1
Matched High Speed Cables with SMA Connectors	Storm, Semflex	8
Power Supply Cables with Clips		3/4 (Note 4)

2. This equipment was used to obtain the measurements.
3. The 50 GHz sample module was used in order to obtain accurate and repeatable rise, fall, and jitter measurements.
4. Additional power supply cables with clips are needed when output level select (OLS) tested (see device data sheet).

Setup

Step 1: Connect Power

1a: Connect the following supplies to the evaluation board via the surface mount clips.

Table 2. POWER SUPPLY SUMMARY TABLE

3.3 V Setup	2.5 V Setup
V_{CC} = 2.0 V	V_{CC} = 2.0 V
V_{TT} = GND	V_{TT} = GND
V_{EE} = −1.3 V	V_{EE} = −0.5 V

Step 2: Connect Inputs

For Differential Mode (3.3 V and 2.5 V operation)

2a: Connect the differential outputs of the generator to the differential inputs of the device (D0/$\overline{D0}$ and D1/$\overline{D1}$).

2b: Depending on configuration, if SELA/SELB is desired to be Logic "High" connect to V_{CC}, or if SEL/SELB is desired to be Logic "Low" connect to V_{TT} or V_{EE} or leave floating.

2c: Connect the generator trigger to the oscilloscope trigger.

For Single-ended Mode (3.3 V operation only)

2a: Connect an AC-coupled output of the generator to the desired differential input of the device.

2b: Connect the unused differential input of the device to V_{TT} (GND) through a 50 Ω resistor.

2c: Depending on configuration, if SELA/SELB is desired to be Logic "High" connect to V_{CC}, or if SEL/SELB is desired to be Logic "Low" connect to V_{TT} or V_{EE} or leave floating.

2d: Connect the generator trigger to the oscilloscope trigger.

All Function Setups

Connect OLS (Output Level Select) to the required voltage to obtain desired output amplitude. Refer to the NBSG72A device data sheet page 3 OLS voltage table.

Step 3: Setup Input Signals

3a: Set the signal generator amplitude to 400 mV. Note that the signal generator amplitude can vary from 75 mV to 900 mV to produce a 400 mV DUT output.

3b: Set the signal generator offset to 660 mV (the center of a nominal RSECL output). Note that the V_{IHCMR} (Input High Voltage Common Mode Range) allows the signal generator offset to vary as long as V_{IH} is within the V_{IHCMR} range. Refer to the device data sheet for further information.

3c: Set the generator output for a square wave clock signal with a 50% duty cycle, or for a PRBS data signal.

Step 4: Connect Output Signals

4a: Connect the outputs of the evaluation board (Q0, $\overline{Q0}$,Q1, $\overline{Q1}$) to the oscilloscope. The oscilloscope sampling head must have internal 50 Ω termination to ground.

NOTE: Where a single output is being used, the unconnected output for the pair **must be** terminated to V_{TT} through a 50 Ω resistor for best operation. Unused pairs may be left unconnected. Since V_{TT} = 0 V, a standard 50 Ω SMA termination is recommended.

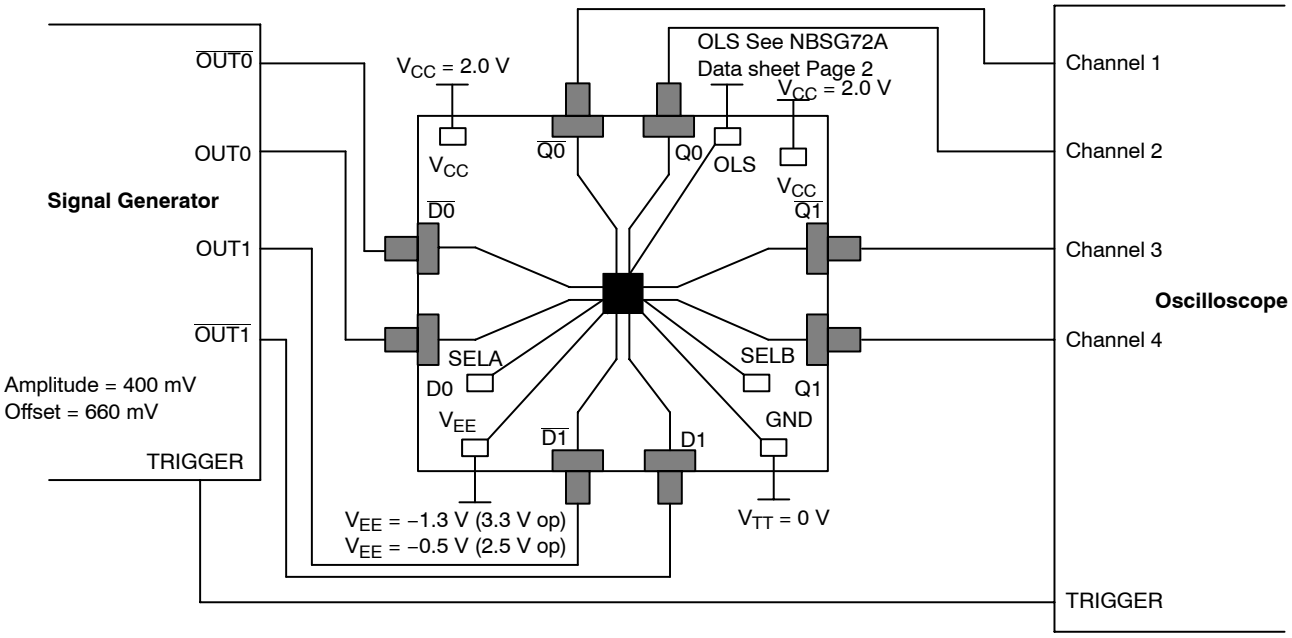


Figure 2. NBSG72A Board Setup − Time Domain (Differential Mode)

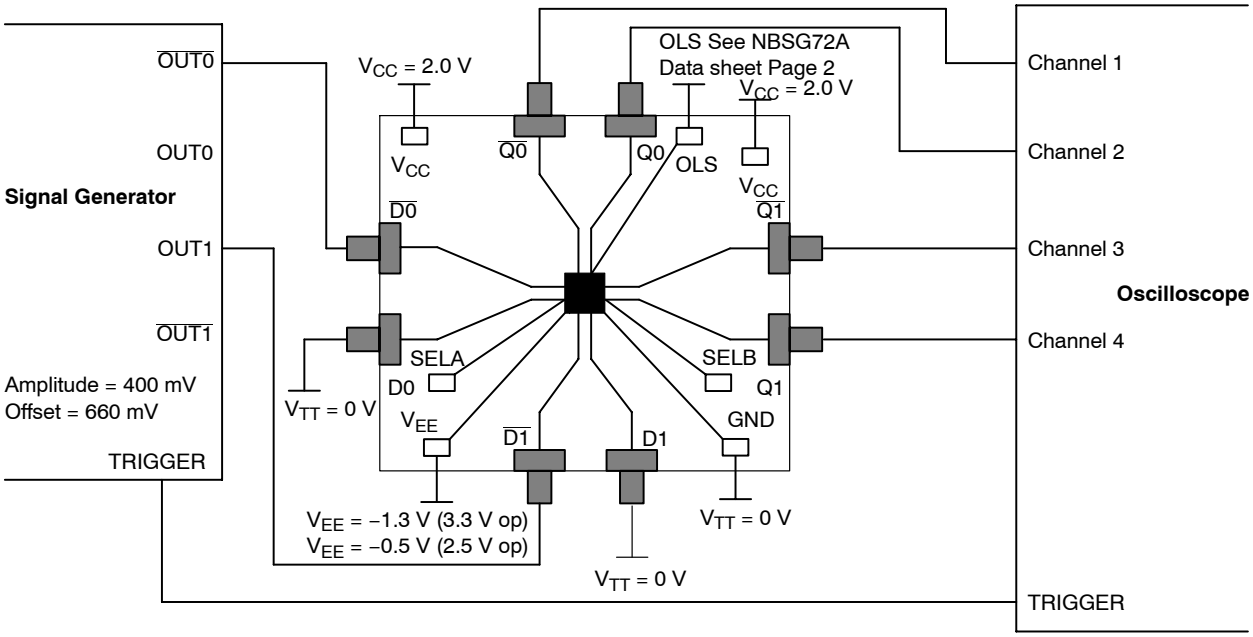


Figure 3. NBSG72AA Board Setup − Time Domain (Single-ended Mode)

SETUP FOR FREQUENCY DOMAIN MEASUREMENTS

Table 3. BASIC EQUIPMENT

Description	Example Equipment (Note 5)	Qty.
Power Supply with 2 Outputs	HP 6624A	1
Vector Network Analyzer (VNA)	R&S ZHOU (10 MHz to 40 GHz)	1
180°C Hybrid Coupler	Krytar Model #4010180	1
Bias Tee with 50 Ω Resistor Termination	Picosecond Model #5542−219	1
Matched High Speed Cables with SMA Connectors	Storm, Semflex	3
Power Supply Cables with Clips		3

5. Equipment used to generate example measurements.

Setup

Step 1: Connect Power

1a: Three power levels must be provided to the board for V_{CC}, V_{EE}, and GND via the surface mount clips. Using the split power supply mode, GND = V_{TT} = V_{CC} – 2.0 V.

Table 4. POWER SUPPLY CONNECTIONS

3.3 V Setup
V_{CC} = 2.0 V
V_{TT} = GND
V_{EE} = −1.3 V

NOTE: For frequency domain measurements, 2.5 V power supply is not recommended because additional equipment (bias tee, etc.) is needed for proper operation. The input signal has to be properly offset to meet V_{IHCMR} range of the device.

Setup Test Configurations for Differential Operation

A) Small Signal Setup

Step 2: Input Setup

2a: Calibrate VNA from 1.0 GHz to 12 GHz.

2b: Set input level to –35 dBm at the output of the 180° Hybrid coupler (input of the DUT).

Step 3: Output Setup

3a: Set display to measure S21 and record data.

B) Large Signal Setup

Step 2: Input Setup

2a: Calibrate VNA from 1.0 GHz to 12 GHz.

2b: Set input levels to −2.0 dBm (500 mV) at the input of DUT.

Step 3: Output Setup

3a: Set display to measure S21 and record data.

Setup Test Configurations For Single-ended Operation

A) Single-ended Mode – Small Signal

Step 2: Input Setup

2a: Calibrate VNA from 1.0 GHz to 12 GHz.

2b: Set input level to –35 dBm at the input of DUT.

Step 3: Output Setup

3a: Set display to measure S21 and record data.

B) Single-ended Mode – Large Signal

Step 2: Input Setup

2a: Calibrate VNA from 1.0 GHz to 12 GHz.

2b: Set input levels to +2 dBm (500 mV) at the input of DUT.

Step 3: Output Setup

3a: Set display to measure S21 and record data.

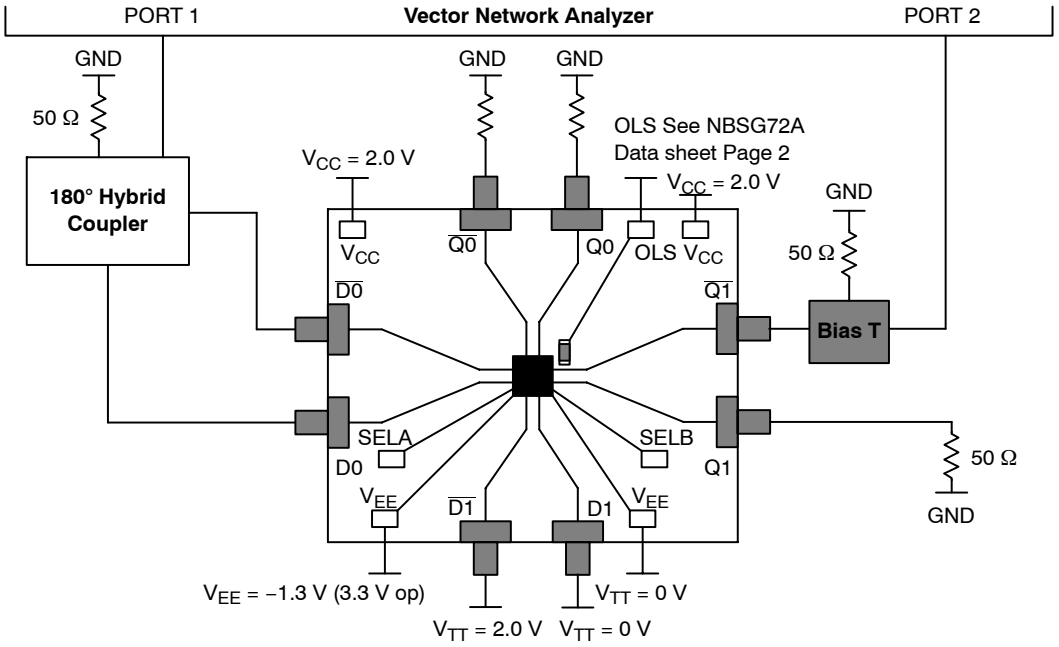


Figure 4. NBSG72A Board Setup − Frequency Domain (Differential Mode)

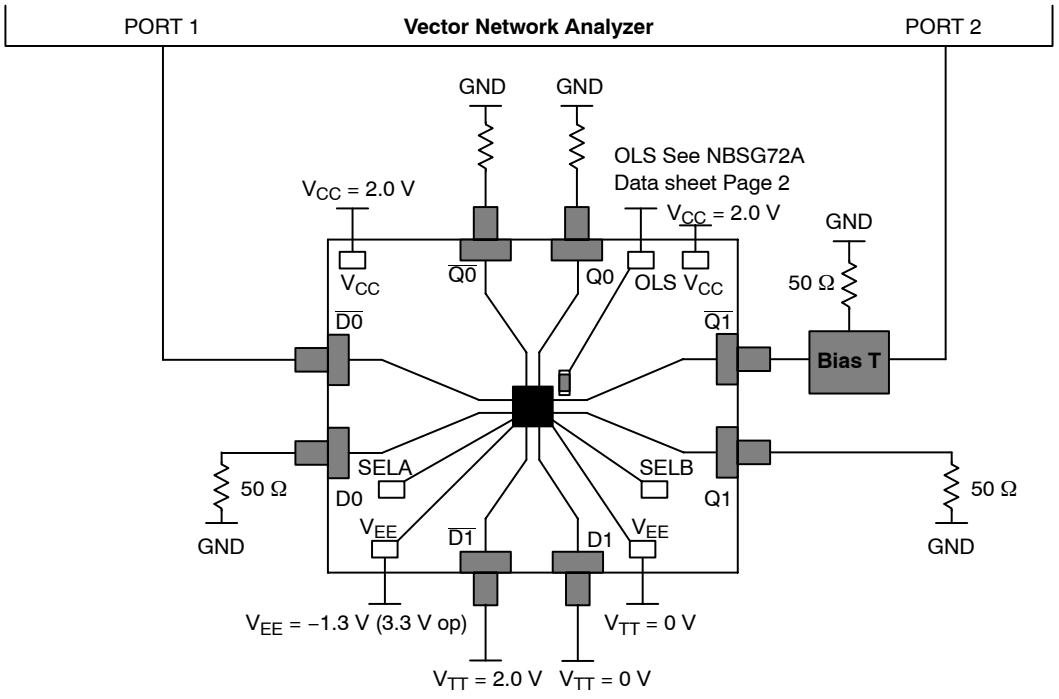


Figure 5. NBSG72A Board Setup − Frequency Domain (Single-ended Mode)

MORE INFORMATION ABOUT EVALUATION BOARD

Design Considerations for >10 GHz Operation

While the NBSG72A is specified to operate at 12 GHz, this evaluation board is designed to support operating frequencies up to 20 GHz.

The following considerations played a key role to ensure this evaluation board achieves high-end microwave performance:

- Optimal SMA Connector Launch
- Minimal Insertion Loss and Signal Dispersion
- Accurate Transmission Line Matching (50 Ω)
- Distributed Effects while Bypassing and Noise Filtering

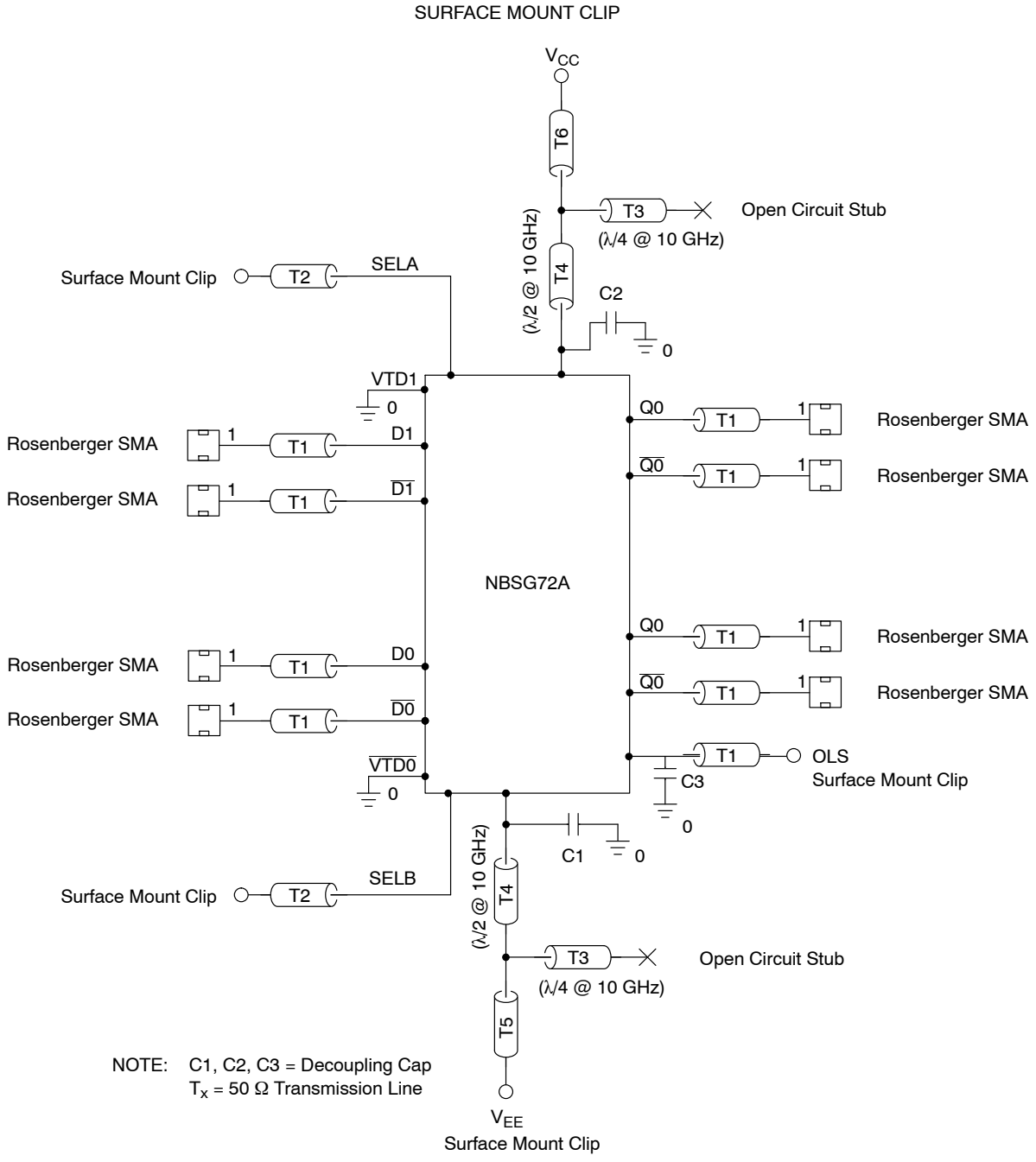


Figure 6. Evaluation Board Schematic

Table 5. PARTS LIST

Part No	Description	Manufacturer	Web Address
NBSG72AMN	SiGe Differential 2×2 Crosspoint Switch with Output Level Select	ON Semiconductor	http://www.onsemi.com
32K243−40ME3	Gold Plated Connector	Rosenberger	http://www.rosenberger.de
CO6BLBB2X5UX	2 MHz − 30 GHz Capacitor	Dielectric Laboratories	http://www.dilabs.com

Table 6. BOARD MATERIAL

Material	Thickness
Rogers 6002	5.0 mil
Copper Plating	32 mil

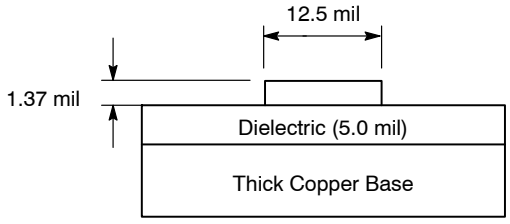


Figure 7. Board Stack-up

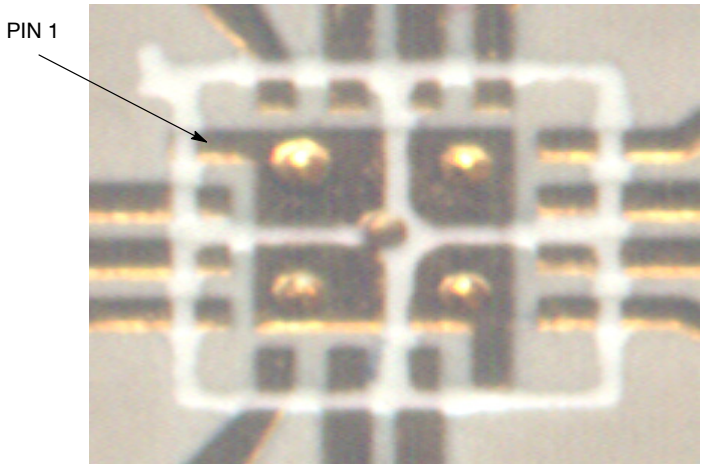
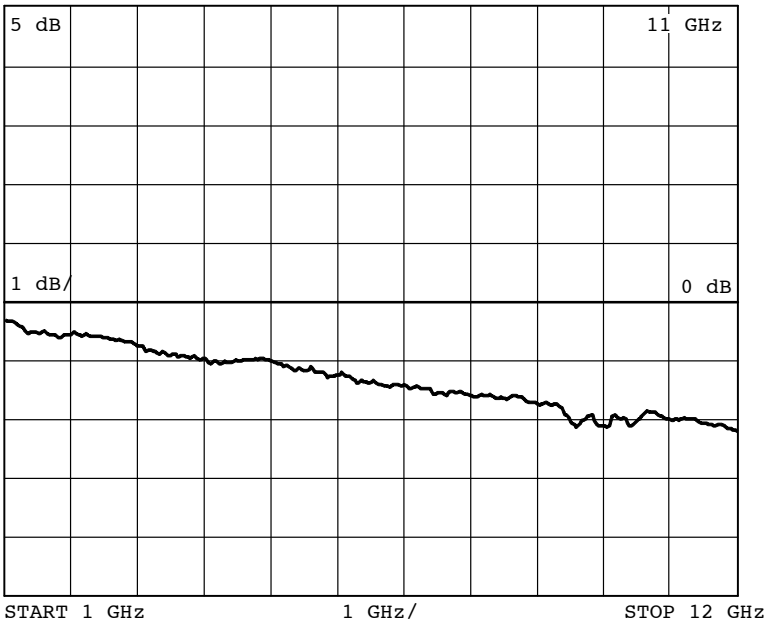


Figure 8. Layout Mask for NBSG72A



NOTE: The insertion loss curve can be used to calibrate out board loss if testing under small signal conditions.

Figure 9. Insertion Loss

ADDITIONAL INFORMATION

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In all cases, the most up-to-date information can be found on our website.

- Sample Orders for Devices and Boards
- New Product Updates
- Literature Download/Order
- IBIS and Spice Models

References

AND8077/D, Application Note, *GigaComm™ (SiGe) SPICE Modeling Kit*

AND8075/D, Application Note, *Board Mounting Considerations for the FCBGA Packages*

NBSG72A/D, Data Sheet, *2.5 V/3.3 V SiGe Differential 2x2 Crosspoint Switch with Output Level Select*

Table 7. ORDERING INFORMATION

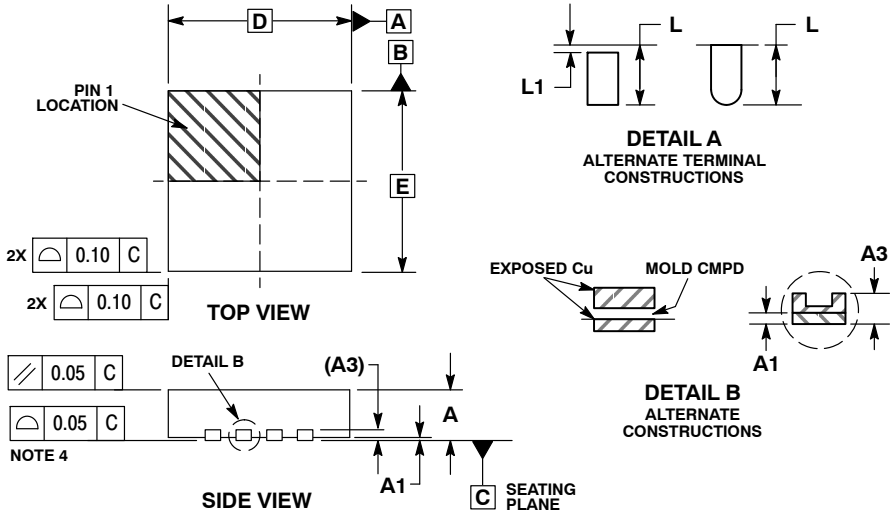
Part No	Description	Package	Shipping†
NBSG72AMN	SiGe Differential 2×2 Crosspoint Switch with Output Level Select	3×3 mm QFN/16	123 Units/Rail
NBSG72AMNR2	SiGe Differential 2×2 Crosspoint Switch with Output Level Select	3×3 mm QFN/16	3,000/Tape & Reel
NBSG72AMNEVB	NBSG72A Evaluation Board		

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

NBSG72AMNEVB

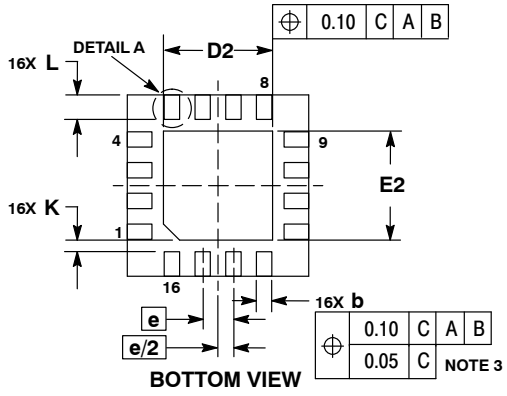
PACKAGE DIMENSIONS

QFN16 3x3, 0.5P
CASE 485G−01
ISSUE F

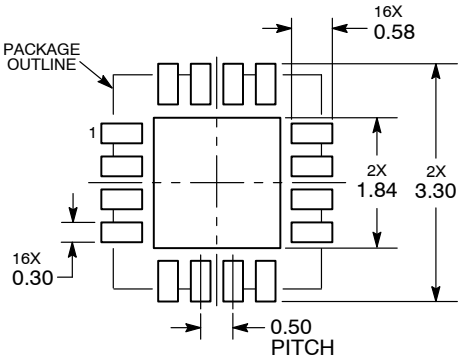


NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

	MILLIMETERS		
DIM	MIN	NOM	MAX
A	0.80	0.90	1.00
A1	0.00	0.03	0.05
A3		0.20 REF	
b	0.18	0.24	0.30
D		3.00 BSC	
D2	1.65	1.75	1.85
E		3.00 BSC	
E2	1.65	1.75	1.85
e		0.50 BSC	
K		0.18 TYP	
L	0.30	0.40	0.50
L1	0.00	0.08	0.15



RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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